

Alberta Oil Sands Industry Quarterly Update

WINTER 2008/2009
(Reporting on the period: October 2008 to Feb. 2, 2009)

Alberta
Government.

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**ALBERTA
OIL SANDS
INDUSTRY
QUARTERLY
UPDATE**

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Government

All about the oil sands

Background of an important global resource



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June Warren-Nickle's Energy Group

Alberta has the second-largest deposit of oil in the world—only Saudi Arabia can claim a larger stockpile of crude. But 173 billion of Alberta's 179 billion barrels of oil have the special quality of being bitumen, a resource that has been developed for decades but is only now coming into the forefront of the global energy industry, as conventional supplies—so-called “easy” oil—continue to be depleted. The figure of 173 billion barrels represents what is considered economically recoverable with today's technology, but with new technologies, this reserve estimate could be increased to as much as 315 billion barrels.

There are three major bitumen (or oil sands) deposits in Alberta. The largest is the Athabasca deposit, located in the province's northeast in the Regional Municipality of Wood Buffalo. The main population centre of the Athabasca deposit is the City of Fort McMurray. The second-largest oil sands deposit is referred to as Cold Lake, just south of Athabasca, with the main population centre the City of Cold Lake. The smallest oil sands deposit is known as Peace River, which is located in northwest central Alberta. A fourth deposit called Wabasca links to the Athabasca and is generally lumped in with that area.

The existence of bitumen in Alberta has been known for a long time. The first mention of it in Canadian history was in 1719, when a Cree named Wapasi brought a sample of the “gum” to a Hudson's Bay trading post. First Nations in what is now the Wood Buffalo area had traditionally used the bitumen, which seeps from outcrops along the Athabasca River, to waterproof their canoes.

Today bitumen is produced as an energy source by two means—mining and in situ. The majority of oil sands production is done by surface mining, but this will likely change in the future,

as 80 per cent of Alberta's bitumen deposits are too deep underground to economically employ this technology.

Right now there are essentially two commercial methods of in situ (“in place,” essentially meaning wells are used rather than trucks and shovels). In cyclic steam stimulation (CSS), high-pressure steam is injected into directional wells drilled from pads for a period of time, then the steam is left to soak in the reservoir for a period, melting the bitumen, and then the same wells are switched into production mode, bringing the bitumen to the surface.

In steam assisted gravity drainage (SAGD), parallel horizontal well pairs are drilled from well pads at the surface. One is drilled near the top of the target reservoir, while the other is drilled near its bottom. Steam is injected into the top well, a steam chamber forms, and via gravity, the melted bitumen flows into the lower well and is pumped to the surface using artificial lift.

Both SAGD and CSS are used in the Cold Lake and Peace River deposits, while SAGD is the in situ technology of choice in the Athabasca deposit. The choice is based on a number of things including geology. The technologies combined currently produce just over one million barrels per day.

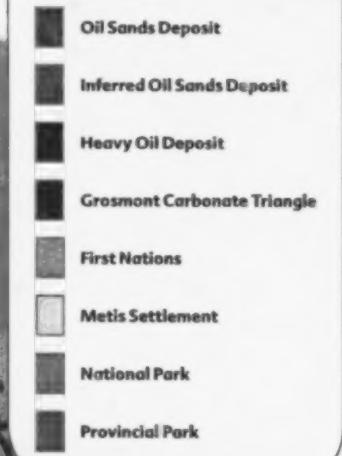
Research is underway on a number of other production technologies designed to optimize production and minimize water and energy use, including vapour extraction (VAPEX), and a form of in situ combustion known as toe to heel air injection (THAI).

Bitumen that has not been processed, or “upgraded,” can be used directly as asphalt. It must be diluted to travel by pipeline. Adding value, some producers upgrade their product into synthetic crude oil (SCO), which is a refinery feedstock. At these refineries it can be transformed into transportation fuels and other products. □

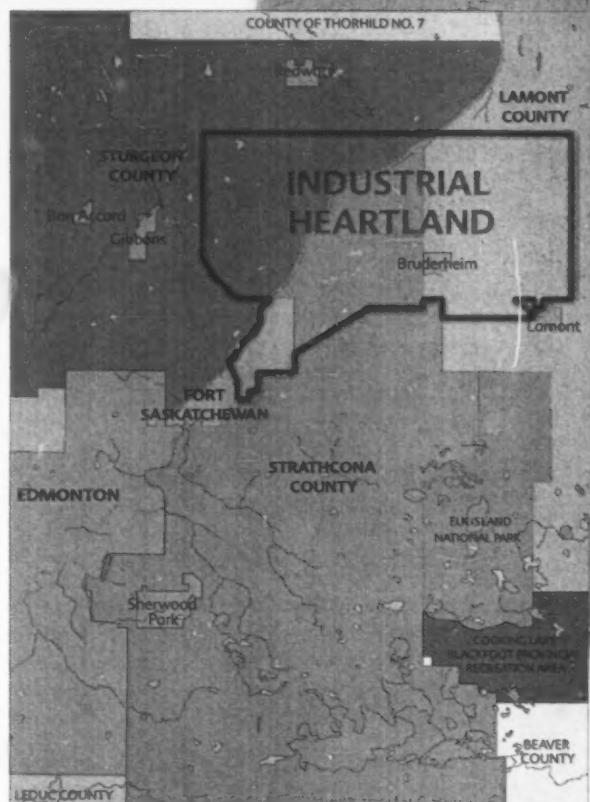
100 KILOMETRES
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Mapping the oil sands

Canada's heavy oil and oil sands resources are often referred to as "the oil that technology made." Without intensive production technology development, the industry would not exist as it does today. These technologies still continue to be advanced and optimized, improving recovery and reducing environmental impacts.



ALBERTA'S INDUSTRIAL HEARTLAND



Alberta's Industrial Heartland is over 78,550 acres in size, and is located within Metro Edmonton, Alberta's Capital Region. This region is key to the value added processing of Alberta's oil sands resources into higher valued refined petroleum products and petrochemicals.

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Background of an important global resource

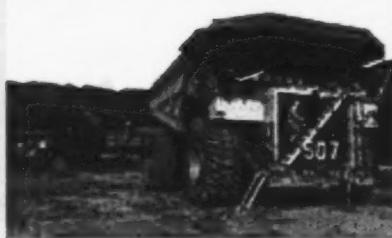


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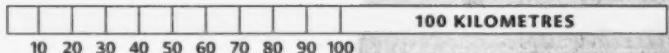
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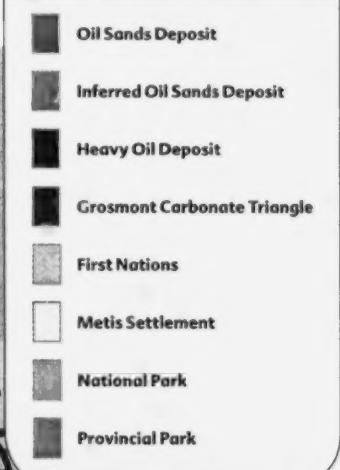
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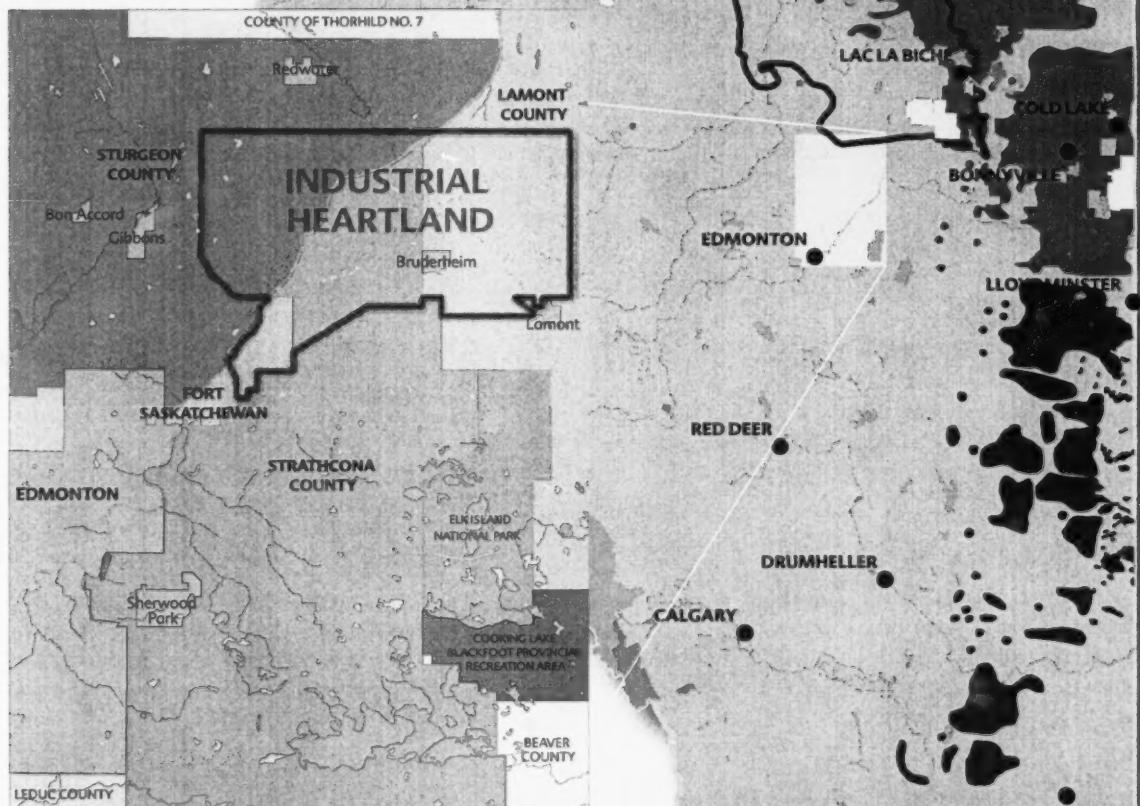


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Government update

Over the past few years, significant oil sands development activity in Alberta contributed to substantial economic growth and associated growth challenges. Due to recent economic realities such as high costs and volatile commodity prices, the pace of development has moderated. This moderation is expected to lead to improved labour availability, cost decreases, and ease of inflationary pressures.

Despite global economic pressures and lower oil prices, the Alberta government will meet its spending commitments for Budget 2008. The province's 2008–09 Second Quarter Fiscal Update shows a forecast surplus of \$2 billion, an increase of \$435 million from budget. The surplus, together with other cash available, will enable government to follow through on its commitment to Carbon Capture and Storage (CCS) projects and the Green Transit Incentives Program (Green TRIP).

The Alberta government released its long-term Provincial Energy Strategy in December. It is a long-term action plan for Alberta to achieve clean energy production, wise energy use, and sustained economic prosperity. The strategy addresses present issues and offers a roadmap to the future of energy development in the province. The strategy recognizes that environmentally responsible and innovative hydrocarbon development remains the cornerstone of Alberta's economy and North American energy supply. It also recognizes the importance of energy conservation, efficiency, and developing renewable energy sources as expanding pieces of the provincial energy portfolio.

In July 2008, the Alberta government announced a \$2-billion fund to kick-start three steel-in-the-ground CCS projects. These projects are expected to reduce greenhouse gas emissions by up to five million tonnes annually by 2015.

CCS projects are being pursued around the world and the technology is fully supported by the United Nations Intergovernmental Panel on Climate Change, the International Energy Agency, and the International Panel on Climate Change.

More than 50 companies submitted Expressions of Interest for the CCS funding. Those 20 that most closely fit with the province's objectives have been asked to submit Full Project Proposals by March 31, 2009. The projects selected to receive funding will be announced by June 30, 2009.

The Government of Alberta is providing the Alberta Energy Research Institute with \$6.6 million in funding for the three-year, \$20-million project near Shell Canada's Scotford facility. Three test wells will be drilled to examine the CO₂ injection capability and storage capacity in formations deep beneath the surface. The field test phase is expected to be completed by June 2010 and will expand the knowledge base of the geologic formations in Alberta that are well suited for carbon storage.

To address rapid growth issues in the oil sands regions, the Government of Alberta created the Oil Sands Sustainable Development Secretariat in the summer of 2007. The secretariat collaborates with ministries, industry, communities, and stakeholders to address the social, infrastructure, environmental, and economic impacts of oil sands development. As a result, a long-term strategic plan for the sustainable development of the oil sands is being developed. The document is expected to be released in early 2009.

Together with industry, the Alberta government has undertaken several studies demonstrating the feasibility of producing refined petroleum products and petrochemicals from bitumen in integrated plants that encompass bitumen upgrading, refining, and petrochemical processing. Several industrial park examples in other countries indicate that additional cost savings and new business opportunities are available where eco-industrial clusters form around such integrated operations.

The Alberta government will continue to explore the full range of potential benefits

that may accrue to the province through such clusters. This includes, but is not limited to, increased local demand for bitumen, market diversification for oil sands-derived products, a reduced environmental footprint, and a more integrated pipeline network for raw material collection and finished product distribution.

The Government of Alberta has proposed to take raw bitumen in lieu of cash royalties to maximize the value received for the bitumen and support the province's value-added strategy. This is not a new concept. The province already takes its royalty share of conventional oil in kind in order to obtain its maximum value for Albertans.

The Government of Alberta invited interested parties to make submissions detailing their interest, and explaining how they would participate in using the government's bitumen royalty-in-kind (BRIK) volumes. Submissions had to reflect the province's objective of maximizing return from its royalty share of bitumen. The deadline for submitting proposals was Oct. 17, 2008. The responses to the Request for Expressions of Interest are being used to better understand potential opportunities leading to a Request for Proposals expected in early 2009.

After further consultation with Albertans, stakeholders, and Aboriginal communities, the Government of Alberta strengthened its draft Land-use Framework. The final Alberta Land-use Framework will ensure future land development considers cumulative environmental impacts as well as social and economic factors. The government will announce more details on the Land-use Framework early in 2009, including the framework's implementation plan and the terms of reference for regional plans.

In November 2008, the Alberta government renewed its Water for Life strategy. The renewed strategy accelerates action to safeguard Alberta's water sources to ensure the integration of watershed planning with regional planning under the proposed Land-use Framework, and sets clear direction and action for improved watershed management in Alberta.

What's new in the oil sands

Key updates from Winter 08/09



and other projects while it figures out what to do with Northern Lights.

The timing is consistent with the long-term strategy to integrate the mine with its other projects, which Total announced when it acquired the mine's previous owner, Syncrude Energy Inc., the company says, adding that Northern Lights remains part of Total's long-term investment in oil sands and the latest development should be characterized as an asset integration.

Canadian Natural Resources Limited (CNRL) reports it is continuing the completion of construction, commissioning and staged start-up of the Horizon oil sands project, but has experienced some challenges primarily related to the more complex components of the plant. These include the delayed coker, the cogeneration plant, the hydrogen plant, the naphtha hydrotreater, and the gas oil hydrotreater.

Baytex Energy Trust says its thermal pilot at Seal in the Peace River bitumen region of northern Alberta suggests a commercial-size operation will be economic at current oil prices.

The trust said it is in the process of putting the organizational resources in place to permit, design, and execute a commercial-scale project, and will periodically provide updates on its progress. Baytex does not expect production from a commercial-scale thermal project at Seal for approximately three years.

Imperial Oil Limited has done in 2008 on its proposed oil sands mining project, the 300,000 barrel per day Keral, will continue into 2009, says a company spokesperson.

"We haven't slowed down," said Pius Rolheiser.

That work includes detailed design engineering, procurement of long lead items, and site preparations such as access road construction and draining of the muskeg overburden, all of which will help the company make a final decision in 2009 as to whether to go ahead with the project, said Rolheiser.

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has withdrawn its application with regulators for the Northern Lights oil sands mine, and says it first wants to focus on its Joslyn North mine

A revised cost and schedule estimate will be made at that time.

StatoilHydro ASA still believes its Alberta bitumen leases will eventually yield more than 200,000 barrels per day, but the timing will be dictated by economics, says a Canadian executive.

Although the company withdrew its regulatory application for a bitumen upgrader with an ultimate capacity of 220,000 barrels per day, it is continuing the regulatory process for full field development, said Bob Skinner, senior vice-president of StatoilHydro Canada.

In 2007, StatoilHydro (then Statoil ASA) entered the Canadian oil sands with its purchase of Alberta-based North American Oil Sands Corporation for \$2.2 billion in cash.

At the time, Statoil said an Alberta upgrader would be built when bitumen output topped about 80,000 barrels per day—probably around the middle of the next decade.

That was later delayed by two years and StatoilHydro has now withdrawn its regulatory application for the upgrader, effectively cancelling the project for now.

With results to date having met or exceeded the company's expectations, Canadian Natural Resources Limited (CNRL) continues to move forward with its plans to expand its Pelican Lake polymer flooding program by applying the process to larger regions of the pool.

As primary recovery at Pelican only offers around five per cent production of oil in place, CNRL has looked to enhanced oil recovery and the results have been encouraging. In 2004, CNRL began converting portions of the field to waterflood and building on the success of that program it commenced polymer flooding in 2005.

Going forward, the program will involve converting many producers to polymer injection wells, which will require a "reservoir fill-up" period of 12 to 18 months prior to seeing a positive crude oil production response from the process.

The result is that 2009 targeted production increase at Pelican Lake is tempered while awaiting response from these conversions. In 2009, CNRL anticipates that 108 wells will be drilled at Pelican, which is located in the Wabasca region of Alberta. >

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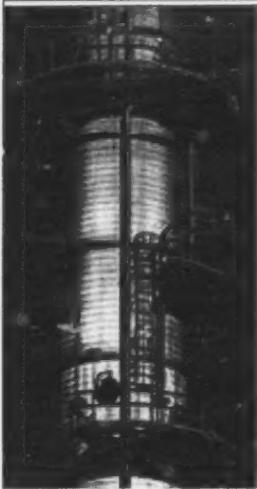
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What's new in the oil sands continued



Excelsior Energy Limited has begun operations for the 2008/2009 winter drilling program to delineate the focus area towards an application for a 10,000 barrel per day steam assisted gravity drainage project in the southeastern portion of the Hangingstone asset.

Planning and engineering studies for the project application have commenced and the company has engaged an environmental consultant and submission coordinator to complete an environmental impact assessment.

Approval of the project application is expected in 2010. Development drilling and construction of the Hangingstone facilities would target production to commence in 2011. The company requires funding for the development and production facilities whose success will depend on market conditions at that time.

North Peace Energy Corp.'s cyclic steam stimulation pilot project is moving forward with construction of the steam generation facilities at least 79 per cent complete.

It's expected that the production portion of the facilities at Red Earth Creek in the Peace River area of northern Alberta will be completed in January 2009 and timed to coincide with the conclusion of steaming the first well.

Petrobank Energy and Resources Ltd. says it is making progress on the approval process for a proposed three-well expansion at its Whitesands in situ in the Athabasca region.

The company said it has received copies of two letters from the Energy Resources Conservation Board to objecting parties indicating that the board has decided the planned expansion has met all regulatory requirements and the board will issue its approval document in due course.

The objective of the expansion is to further demonstrate Petrobank's proprietary THAI (toe to heel air injection) technology, an in situ combustion method. The expansion will enable the company to draw upon the knowledge and expertise gained through the development of its existing Whitesands project.

Royal Dutch Shell plc continues to progress plans for a major thermal oil project near Peace River in northwestern Alberta.

But, in light of an ongoing internal review of the project, the company has decided to withdraw its regulatory application and file a new one.

In December 2006, Shell applied for a 100,000 barrel per day CSS project. As filed, the development, which Shell calls Carmon Creek, would be done in two 50,000 barrel per day phases.

When the new application will be filed hasn't been decided, but the company will have more information in early 2009.

Opti Canada Inc. has appointed TD Securities Inc. to assist in its previously announced review of funding options for its continuing cash requirements in 2009.

The review will include an assessment of a range of funding options including asset sales, new debt, and/or new equity.

Opti does not expect to update its progress with respect to the review of options until the board of directors authorizes any transaction or if required by disclosure requirements.

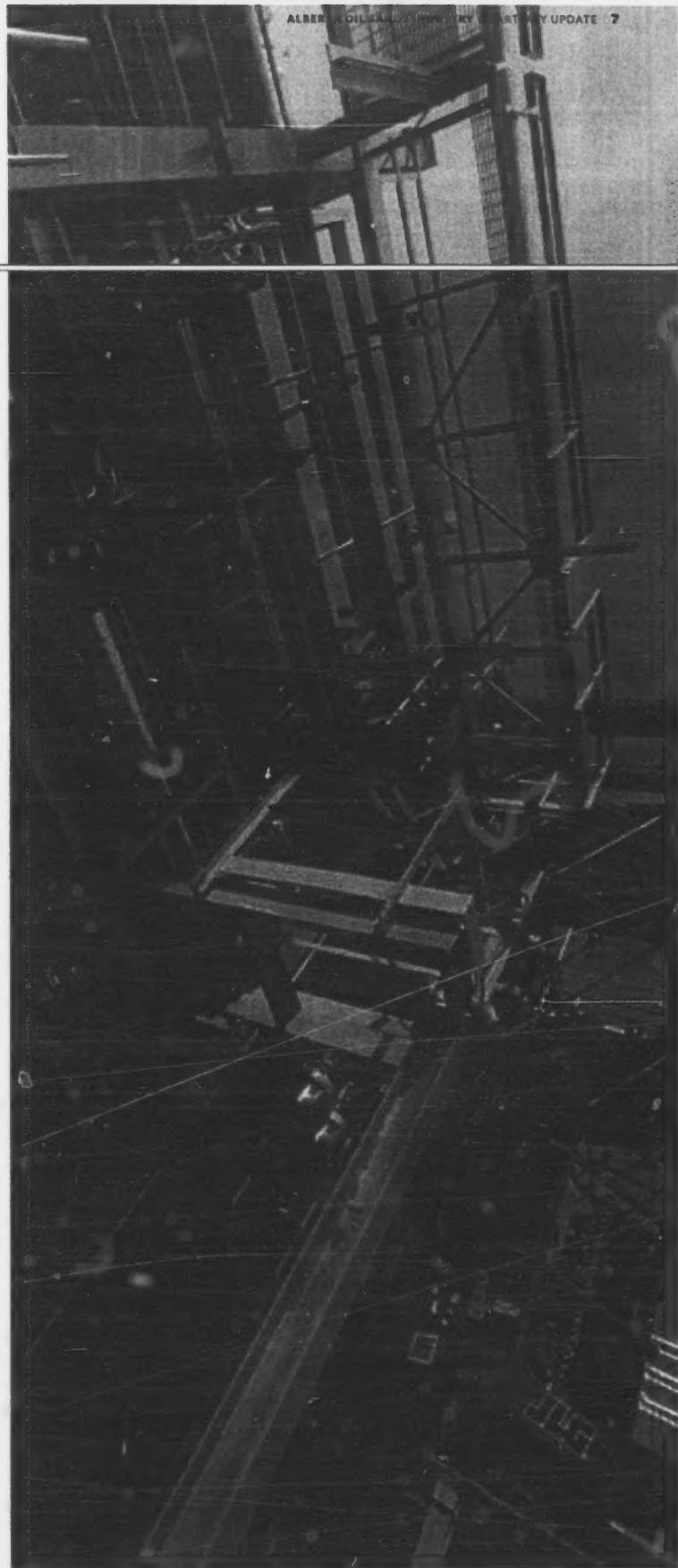
As of Nov. 11, 2008 it had approximately \$324 million of cash on hand (excluding the company's interest reserve accounts). These resources are expected to be sufficient through start-up of the Long Lake upgrader and into early to mid-2009.

Hoping to take advantage of a softening market to reduce cost, Fort Hills Energy Limited Partnership has deferred a final investment decision on the mining portion of the \$23.8-billion project until costs are wrestled down.

The partnership now anticipates making a final investment decision in 2009, but "it will be well into next year," said Neil Camarta, senior vice-president of oilsands for Petro-Canada, operator of the project.

The Sturgeon upgrader portion of the project will be put on hold and a decision on whether to proceed with it will be made at a later date.

Southern Pacific Resource Corp. has completed an engineering Design Basis Memorandum (DBM) and cost estimate for its McKay steam assisted gravity drainage (SAGD) project, which is expected to cost \$414.6 million.



The DBM defines the important project design conditions, production forecasts, facility specifications, and process flow. Also included within the DBM is a project execution plan including contracting strategy, schedule, and cost estimates.

Completion of the DBM keeps Southern Pacific on track to apply for its SAGD project by April 30, 2009.

Royal Dutch Shell plc has indefinitely delayed plans for a pilot test on its vast land position in the Grosmont bitumen carbonates of northern Alberta, citing the province's cost inflation as one of the reasons.

Shell's decision is at least a psychological setback for attempts to commercialize Alberta's estimated hundreds of billions of barrels of in-place bitumen in carbonate rock.

While several companies have recently expressed interest in commercializing their bitumen carbonate resources, Shell was the most prominent because of its size and the price it paid for the acreage, which was high even by the standards of the recent oil sands land rush.

The supermajor—which spent about half a billion dollars on rights to the Grosmont formation—has no intention of walking away from its investment, but says it now plans to proceed at a more modest pace.

A Canadian subsidiary of privately held United States-based **Koch Industries Inc.** has begun the public consultation process for a proposed 10,000 barrel per day SAGD project located 30 kilometres southeast of Bonnyville, Alberta.

Koch Exploration Canada, headquartered in Calgary, holds 100 per cent interest in the proposed project, which it has dubbed Gemini.

Koch says that pending regulatory approvals, the company hopes to commence construction of the central plant facilities in January of 2010.

Connacher Oil and Gas Limited says it has been advised that the Lieutenant Governor in Council has authorized the ERCB to approve its 10,000 barrel per day Algar SAGD project.

This order in council represents the last formal requirement enabling the Energy Resources Conservation Board to issue the approval for Connacher to proceed. •

Project listing

Updated status of oil sands projects in Alberta

As of Feb. 2, 2009 with files from Strategy West.

TECHNOLOGY LEGEND	
CSS	Cyclic steam stimulation
ET-DSP	Electro-thermal dynamic stripping process
N-SOLV	Heated solvent vapour extraction
SAGD	Steam assisted gravity drainage
THAI	Toe to heel air injection

COMPANY	CURRENT PROJECT	CAPACITY (bbl/d)	REGULATORY STATUS	DEVELOPMENT PROGRESS	TECHNOLOGY
ATHABASCA REGION - IN SITU					
ALBERTA OIL SANDS					
Clearwater	Pilot	2,000	2010	Announced	SAGD
	Commercial Project	10,000	2012	Announced	SAGD
ATHABASCA OIL SANDS					
Dover	Pilot	1,000-2,000	2010	Applied	SAGD
Thickwood	Pilot	1,000-2,000	2010	Announced	SAGD
	Phase 1	20,000-40,000	2014	Announced	SAGD
CANADIAN NATURAL RESOURCES					
Birch Mountain	Phase 1	60,000	2017	Announced	TBA
Gregoire Lake	Phase 1	60,000	2020	Announced	TBA
Grouse	Phase 1	60,000	2015	Announced	TBA
Kirby	Phase 1	45,000	2012	Applied	SAGD
Leismer	Phase 1	30,000	2023	Announced	TBA
CHEVRON CANADA					
Els River		100,000	2015	Announced	Chevron is looking at "a range of thermal and enhanced recovery technologies."
CONNACHER OIL AND GAS					
Great Divide	Pod 1	10,000	2007	Operating	SAGD
	Pod 2 (Algar)	10,000	2009	Approved	SAGD
CONOCOPHILLIPS CANADA					
Surmont	Phase 1	27,000	2008	Operating	SAGD
	Phase 2	83,000	2013	Approved	SAGD
DEVON CANADA					
Jockfish	Phase 1	35,000	2008	Operating	SAGD
	Phase 2	35,000	2011	Approved	SAGD
ENCANA					
Borealis	Phase 1	35,000	2015	Applied	SAGD
	Phase 2	32,500	TBD	Announced	SAGD
	Phase 3	32,500	TBD	Announced	SAGD
	Phase 1A	10,000	2002	Operating	SAGD
	Phase 1B	8,800	2008	Operating	SAGD
	Phase 1C	40,000	2010	Under construction	SAGD
	Phase 1D	40,000	2011	Approved	SAGD
Christina Lake	Unnamed Expansion 1	30,000	2012	Announced	SAGD
	Unnamed Expansion 2	30,000	2013	Announced	SAGD
	Unnamed Expansion 3	30,000	2014	Announced	SAGD
	Unnamed Expansion 4	30,000	2015	Announced	SAGD
	Unnamed Expansion 5	30,000	2016	Announced	SAGD
ENERPLUS RESOURCES					
Kirby	Phase 1	10,000	2011	Application	SAGD
	Phase 2	25,000	2017	Announced	SAGD
E-T ENERGY					
Poplar Creek		1,000	2006	Approved	ET-DSP
					Expanded field test underway and planning for commercial implementation of ET-DSP (production using electrodes).



COMPANY	CURRENT PROJECT	CAPACITY (Mb/d)	YEAR	REGULATORY STATUS	DEVELOPMENT PROGRESS	TECHNOLOGY
EXCELSIOR ENERGY						
Hangingstone	Phase 1	10,000	2011	Announced	Excelsior says it is funded to complete the winter season drilling and seismic operations to fully meet all requirements to submit a demonstration project application in Q2 2009.	SAGD
GRIZZLY ENERGY						
Algar Lake		10,000	2011	Announced	Application expected in 2008. Grizzly also has 17 more potential project locations.	SAGD
HUSKY ENERGY						
McMullen	Pilot	775	2010	Application		SAGD
	Phase 1	50,000	2012	Approved		SAGD
Sunrise	Phase 2	50,000	2014	Approved	Area infrastructure and site preparation including roads and well pads progresses. Corporate sanction pending.	SAGD
	Phase 3	50,000	2016	Approved		SAGD
	Phase 4	50,000	2018	Approved		SAGD
JAPAN CANADA OIL SANDS						
Hangingstone	Pilot	10,000	2002	Operating	Regulatory application for commercial phase 1 to be filed in 2010, pending completion of further engineering work and an environmental impact assessment.	SAGD
	Phase 1	25,000	2014	Disclosed		SAGD
	Phase 2	25,000	TBA	Disclosed		SAGD
KOREA NATIONAL OIL CORPORATION						
BlackGold	Phase 1	10,000	2010	Application		SAGD
	Phase 2	20,000	TBD	Announced		SAGD
LARICINA ENERGY						
Germain	SAGD pilot	600	2011	Application	Approval expected in Q1/Q2 2009. Laricina reports increased confidence in expected reservoir performance. Has decreased capacity by 1,200 barrels per day, and pushed start-up out by two years.	SAGD
	Phase 1	10,000	2012	Announced	Regulatory application expected in Q1 2009.	SAGD
	Phase 2	20,000	2014	Announced		SAGD
	Phase 3	35,000	2020	Announced		SAGD
	Phase 4	35,000	2017	Announced		SAGD
	Phase 5	50,000	TBD	Announced		SAGD
Saleski	Carbonate SAGD demonstration	1,200	2010	Application	To be developed before Germain. Approval expected in Q1/Q2 2009. Capacity reduced by 600 barrels per day, start-up pushed by a year.	SAGD
	Phase 1	10,000	2013/14	Announced	Regulatory application to be filed in 2010.	SAGD
	Phase 2	20,000	2016	Announced		SAGD
	Phase 3	60,000	2019	Announced		SAGD
	Phase 4	60,000	2021	Announced		SAGD
	Phase 5	50,000	2021	Announced		SAGD
MEG ENERGY						
Christina Lake	Phase 1	3,000	2008	Operating	Production commenced April 2008.	SAGD
	Phase 2	22,000	2009	Approved	Construction underway.	SAGD
	Phase 2B	35,000	2011	Application	Regulatory approval anticipated Q1 2008.	SAGD
	Phase 3A	75,000	2012	Announced	Application filed April 2008.	SAGD
	Phase 3B	75,000	2014	Announced		SAGD
NEXEN						
Long Lake	Phase 1	72,000	2007	Operating	Steam capacity and reliability improving. Average production volumes in first half of October 15 are 200 barrels per day.	SAGD
	Phase 2	72,000	TBD	Announced	Sanctioning deferred until late 2009.	SAGD
	Phase 3	72,000	TBD	Announced		SAGD
	Phase 4	72,000	TBD	Announced		SAGD
Long Lake South	Phase 1	70,000	TBD	Applied		SAGD
	Phase 2	70,000	TBD	Applied		SAGD

COMPANY	CURRENT PROJECT	CAPACITY (bb/d)	REGULATORY STATUS	DEVELOPMENT PROGRESS	TECHNOLOGY
N-SOLV	Pilot plant	2,000	2008	Announced	N-SOLV
PATCH INTERNATIONAL	Els River	10,000	2010	Announced	SAGD
PETROBANK ENERGY AND RESOURCES					
Whitesands	Pilot	1,900	2006	Operating	THAI
	Expansion	1,900	2008	Applied	THAI
May River	Phase 1	10,000-15,000	2010	Applied	THAI
	Subsequent Phases	90,000	TBD	Disclosed	
PETRO-CANADA					
Chard	Phase 1	40,000	TBD	Announced	SAGD
Lewis	Phase 1	40,000	TBD	Disclosed	SAGD
	Phase 2	40,000	TBD	Disclosed	SAGD
Mackay River	Phase 1	33,000	2002	Operating	SAGD
	Phase 2	40,000	2012	Approved	SAGD
Meadow Creek	Phase 1	40,000	TBD	Approved	SAGD
	Phase 2	40,000	TBD	Approved	SAGD
SERRANO ENERGY					
Brockrod	Pilot	500	2009	Application	SAGD
SOUTHERN PACIFIC RESOURCES					
STP McKay		12,000	2011	Announced	SAGD
STATOILHYDRO CANADA					
Kai Kos Detseh-Leismer	Demonstration	10,000	2009	Under construction	SAGD
Leismer	Commercial Expansion	20,000	2010	Applied	SAGD
Comer		20,000	2011	Applied	SAGD
Thombury		40,000	2012	Applied	SAGD
Comer	Expansion	40,000	2013	Applied	SAGD
Hangingstone		40,000	2014	Applied	SAGD
Thombury	Expansion	20,000	2015	Applied	SAGD
Northwest Leismer		20,000	2017	Applied	SAGD
South Leismer		20,000	2018	Applied	SAGD
SUNCOR ENERGY					
Firebag	Phase 1	33,000	2004	Operating	SAGD
	Phase 2	35,000	2006	Operating	SAGD
	Cogeneration and Expansion	25,000	2007	Operating	SAGD
	Phase 3	52,500	2009	Construction suspended	SAGD
	Phase 4	62,500	2010	Application	SAGD
	Phase 5	62,500	2012	Application	SAGD
	Phase 6	62,500	2012	Application	SAGD
	Stages 3-6 Debottlenecking	23,500	2014	Application	SAGD
SUNSHINE OIL SANDS					
West Ells	Phase 1	10,000	TBD	Announced	SAGD
	Phase 2	30,000	2015	Announced	SAGD
	Phase 3	25,000	2018	Announced	SAGD
Thickwood	Phase 1	10,000	TBD	Announced	SAGD
	Phase 2	30,000	2017	Announced	SAGD
	Phase 3	25,000	2020	Announced	SAGD
TOTAL E&P CANADA					
Joslyn	Phase 1	2,000	2006	Operating	SAGD
	Phase 2	10,000	2006	Operating	SAGD
	Phase 3A	15,000	2009	Application	SAGD
	Phase 3B	15,000	2012	Disclosure	SAGD

COMPANY	CURRENT PROJECT	CAPACITY (bbl/d)	START DATE	REGULATORY STATUS	DEVELOPMENT PROGRESS	TECHNOLOGY
VALUE CREATION GROUP						
Syncrude	Pilot	10,000	2010	Application		SAGD
	Phase 1	40,000	TBD	Applied		SAGD
	Phase 2	40,000	TBD	Announced		SAGD
ATHABASCA REGION – MINING						
ATHABASCA OIL SANDS PROJECT						
Jackpine	Phase 1A	100,000	2010	Under construction		Mining
	Phase 1B	100,000	2012	Approved		Mining
	Phase 2	100,000	2014	Application		Mining
Muskeg River	Existing Facilities	155,000	2002	Operating		Mining
Pierre River	Expansion and Debottlenecking	115,000	TBD	Approved	Final investment decision delayed.	Mining
	Phase 1	100,000	2018	Applied		Mining
		100,000	2021	Applied		Mining
CANADIAN NATURAL RESOURCES					Canadian Natural continues completion of construction, commissioning, and staged start-up. First SCO production anticipated in December 2008, but management recognizes this would require no further delays.	
Horizon	Phase 1	135,000	2008	Operating		Mining
	Phases 2 and 3	135,000	TBD	Approved		Mining
	Phase 4	145,000	TBD	Announced		Mining
	Phase 5	162,000	TBD	Announced		Mining
IMPERIAL OIL					Detailed engineering, procurement of long lead items and site preparation continues. Sanction decision and revised cost and schedule expected in 2009.	
Kearl	Phase 1	100,000	2012	Approved		Mining
	Phase 2	100,000	TBD	Approved		Mining
	Phase 3	100,000	TBD	Approved		Mining
PETRO-CANADA					Final investment decision delayed. Expected now some time in 2009.	
Fort Hills	Phase 1	165,000	2011	Approved		Mining
	Debottlenecking	25,000	TBD	Approved		Mining
SUNCOR ENERGY						
	Millennium	294,000	1967	Operating		Mining
	Steeplebank	4,000	2007	Operating		Mining
	Debottleneck Phase 3	4,000	2007	Operating		Mining
	Millennium	23,000	2008	Operating		Mining
	Debottlenecking					
	North Steeplebank					
	Extension					
Voyageur South	Phase 1	120,000	2012	Applied		Mining
SYNCRUDE (MILDRED LAKE AND AURORA)						
	Stages 1 and 2	290,700	1978	Operating		Mining
	Stage 3 Expansion	116,300	2006	Operating		Mining
	Stage 3 Debottleneck	46,500	2011	Announced		Mining
	Stage 4 Expansion	139,500	2015	Announced		Mining
TOTAL E&P CANADA						
Joslyn	Phase 1 (North)	50,000	2015	Applied		Mining
	Phase 2 (North)	50,000	2018	Applied		Mining
	Phase 3 (South)	50,000	2021	Announced		Mining
	Phase 4 (South)	50,000	2024	Announced		Mining
Northern Lights	Phase 1	57,250	TBD	Application		Mining
	Phase 2	57,250	TBD	Application		Mining
UTS/TECK COMINCO						
Equinox (previously known as Lease 14)		50,000	2014-2017	Public disclosure	Regulatory application expected in mid-2009.	Mining
Frontier	Phase 1	100,000-160,000	2015-2017	Public disclosure	Regulatory application expected in mid-2010.	Mining
COLD LAKE REGION – IN SITU						
BR OIL SANDS (SHELL)						
Orion	Phase 1	10,000	2008	Operating		SAGD
	Phase 2	10,000	2009	Approved		SAGD
CANADIAN NATURAL RESOURCES						
	Wolf Lake	13,000	1985	Operating		CSS
	Wolf Lake SAGD	5,500	2010	Application		SAGD
	Primrose South	45,000	1985	Operating		CSS

COMPANY	CURRENT PROJECT	CAPACITY (bbl/d)	STAKE (%)	REGULATORY STATUS*	DEVELOPMENT PROGRESS	TECHNOLOGY
CANADIAN NATURAL RESOURCES continued						
	Primrose North	30,000	2006	Operating		CSS
	Primrose East (Burnt Lake)	32,000	2009	Operating	First steam commenced in September 2008. First production in October, ahead of schedule in Q1 2009.	CSS
	CSS Follow-up Process	30,000	2018	Announced		CSS
ENCANA						
Foster Creek	Phase 1A	24,000	2001	Operating		SAGD
	Debottlenecking	6,000	2003	Operating		SAGD
	Phase 1C – Stage 1	10,000	2005	Operating		SAGD
	Phase 1C – Stage 2	20,000	2007	Operating		SAGD
	Phase 1D	30,000	2008	Approved		SAGD
	Phase 1E	30,000	2009	Under construction		SAGD
	Phase 1F	30,000	2011	Application		SAGD
HUSKY ENERGY						
Caribou	Demonstration Project	10,000	2010	Approved	Technical field work continues.	SAGD
Tucker	Phase 1	30,000	2006	Operating	Optimization strategies continue. Three wells on one of the well pads, which were modified to improve the effectiveness of steam heating the reservoir, have commenced heating. Two well pairs commenced production in September. Drilling on the new pad is scheduled for 2009.	SAGD
IMPERIAL OIL						
	Phases 1-10: Leming, Maskwa, Mahikan	110,000	1985	Operating		CSS
	Phases 11-13: Mahkeses	30,000	2003	Operating		CSS
	Phases 14-16: Nabiyé, Mahikan North	30,000	TBD	Approved		CSS
	LASER (CSS follow-up process)	N/Q	2007	Operating	Successful pilot leading to commercialization on 10 well pads.	CSS
KOCH EXPLORATION CANADA						
Gemini	SAGD Project	10,000	TBD	Announced	Koch is in very early stages of development. Detailed engineering and environmental studies will be done, and Koch says community feedback will help determine the scope.	SAGD
OSUM OIL SANDS						
Toigo	SAGD Project	25,000-35,000	2014	Application pending	OSUM has issued its public disclosure document and started open houses.	SAGD
PENN WEST ENERGY TRUST						
Lindbergh	SAGD Pilot	2,500	2009	Application	Work on pilot continues. Evaluation of existing pilot facility equipment and additional surface facility engineering work underway during Q3 2008, also conducting a detailed review of the facility design.	SAGD
PEACE RIVER REGION – IN SITU						
ANDORA ENERGY (PAN ORIENT)						
Sawn Lake	SAGD Demonstration	1,400	2009	Application	If the demonstration plant meets Andora's expectations, a full-scale development would follow.	SAGD
NORTH PEACE ENERGY						
Red Earth	CSS Pilot	1,001	2008	Operating		CSS
	Phase 1	10,000	2013	Announced		CSS
	Phase 2	10,000	TBD	Announced		CSS
	Phase 3	10,000	TBD	Announced		CSS
PENN WEST ENERGY TRUST						
Seal	CSS Pilot	75	2009	Application		CSS
PETROBANK/DUVERNAY						
Dawson	THAI Demonstration	N/Q	2008	Announced	Shell will acquire Duvernay for \$5.9 billion.	THAI
SHELL CANADA						
Common Creek	Cadotte Lake	12,501	1986	Operating		CSS
	Phase 1	37,500	2010	Withdrawn	Shell has withdrawn its application, and is conducting an internal review of the project. Will submit a new application in 2009.	CSS
	Phase 2	50,000	2015	Withdrawn		CSS
ATHABASCA REGION – UPGRADING						
CANADIAN NATURAL RESOURCES						
Horizon	Phase 1	135,000	2008	Operating	Canadian Natural continues completion of construction, commissioning, and staged start-up. First SCO production anticipated in December 2008, but management recognizes this would require no further delays.	Upgrader
	Phases 2 and 3	135,000	TBD	Approved		Upgrader
	Phase 4	145,000	TBD	Announced		Upgrader
	Phase 5	162,000	TBD	Announced		Upgrader

COMPANY	CURRENT PROJECT	CAPACITY (bbl/d)	REGULATORY STATUS	DEVELOPMENT PROGRESS	TECHNOLOGY					
NEXEN										
Long Lake	Phase 1	72,000	2008	Operating	Upgrader					
	Phase 2	72,000	TBD	Approved	Upgrader					
	Phase 3	72,000	TBD	Announced	Upgrader					
	Phase 4	72,000	TBD	Announced	Upgrader					
	Phase 5	72,000	TBD	Announced	Upgrader					
	Phase 6	72,000	TBD	Announced	Upgrader					
SUNCOR ENERGY										
Voyager	Base U1 and U2	281,000	1967	Operating	Upgrader					
	Millennium Vacuum Unit	43,000	2005	Operating	Upgrader					
	Millennium Coker Unit	116,000	2008	Operating	Upgrader					
	Phase 1	156,000	2012	Approved	Upgrader					
	Phase 2	78,000	2012	Approved	Upgrader					
	Syncrude emissions reduction project continues.									
SYNCRUDE										
Mildred Lake	Stages 1 and 2	290,700	1978	Operating	Upgrader					
	Stage 3 Expansion	116,300	2006	Operating	Upgrader					
	Stage 3 Debottleneck	46,500	2012	Announced	Upgrader					
	Stage 4 Expansion	139,500	2016	Announced	Upgrader					
INDUSTRIAL HEARTLAND REGION – UPGRADING AND REFINING										
ATHABASCA OIL SANDS PROJECT										
Scotford Upgrader 1		155,000	2003	Operating	Upgrader					
	Expansion	90,000	2010	Under construction	Upgrader					
	Phase 1	100,000	2012	Applied	Upgrader					
	Phase 2	100,000	TBD	Application	Upgrader					
	Phase 3	100,000	TBD	Application	Upgrader					
	Phase 4	100,000	TBD	Application	Upgrader					
BA ENERGY										
Heartland Upgrader	Phase 1	54,400	TBD	Approved	Upgrader					
	Phase 2	54,400	TBD	Approved	Upgrader					
	Phase 3	54,400	TBD	Approved	Upgrader					
	BA Energy owner Value Creation has shelved the Heartland Upgrader and says it will be up to four years before it will revisit the project.									
	Site preparation complete. Focus is on commercial agreements.									
	Phase 1	50,000	2012	Approved	Upgrader					
NORTH WEST UPGRADING										
Upgrader	Phase 2	50,000	2013	Approved	Upgrader					
	Phase 3	50,000	2015	Approved	Upgrader					
	Construction decision on Fort Hills upgrader has been deferred.									
	Phase 1	165,000	2011	Approved	Upgrader					
	Phases 2 and 3	175,000	2014	Approved	Upgrader					
	Construction complete.									
PETRO-CANADA										
Fort Hills Upgrader	Phase 1	135,000	2008	Approved	Upgrader					
	Phases 2 and 3	175,000	2014	Approved	Upgrader					
	Construction complete.									
	Construction decision on Fort Hills upgrader has been deferred.									
	Phase 1	75,000	TBD	Withdrawn	Upgrader					
	Phase 2	175,000	TBD	Withdrawn	Upgrader					
STATOILHYDRO CANADA										
StatOilHydro Upgrader	Phase 1	75,000	TBD	Withdrawn	Upgrader					
	Phase 2	175,000	TBD	Withdrawn	Upgrader					
	Construction complete.									
	Construction decision on Fort Hills upgrader has been deferred.									
	Phase 1	153,000	2015	Application	Upgrader					
	Phase 2	82,000	2018	Application	Upgrader					
TOTAL E&P CANADA										
Northern Lights Upgrader	Phase 1	56,500	TBD	Withdrawn	Upgrader					
	Phase 2	56,500	TBD	Withdrawn	Upgrader					
	Construction complete.									
	Construction decision on Fort Hills upgrader has been deferred.									
	Pilot	10,000	TBD	Application	Upgrader					
	Phase 1	40,000	TBD	Announced	Upgrader					
VALUE CREATION										
Terre de Grose Upgrader	Phase 2	40,000	TBD	Announced	Upgrader					
	Construction complete.									
	Construction decision on Fort Hills upgrader has been deferred.									
	Construction complete.									
	Construction decision on Fort Hills upgrader has been deferred.									
	Construction complete.									
PEACE RIVER REGION – UPGRADING										
BLUESKY REFINING										
Upgrader	Phase 1	50,000	TBD	Announced	Upgrader					
	Phase 2	50,000	TBD	Announced	Upgrader					
	Phase 3	50,000	TBD	Announced	Upgrader					
	Phase 4	50,000	TBD	Announced	Upgrader					
	Construction complete.									
	Construction decision on Fort Hills upgrader has been deferred.									

Glossary of oil sands terms

API

An American Petroleum Institute measure of liquid gravity. Water is 10 degrees API, and a typical light crude is from 35 to 40. Bitumen is 7.5 to 8.5.

Barrel

The traditional measurement for crude oil volumes. One barrel equals 42 US gallons (159 litres). There are 6.29 barrels in one cubic metre of oil.

Bitumen

Naturally occurring, viscous mixture of hydrocarbons that contains high levels of sulphur and nitrogen compounds. In its natural state, it is not recoverable at a commercial rate through a well because it is too thick to flow. Bitumen typically makes up about 10 per cent by weight of oilsand, but saturation varies.

Condensate

Mixture of extremely light hydrocarbons recoverable from gas reservoirs. Condensate is also referred to as a natural gas liquid, and is used as a diluent to reduce bitumen viscosity for pipeline transportation.

Cyclic steam stimulation

For several weeks, high-pressure steam is injected into the formation to soften the oilsand before being pumped to the surface for separation. The pressure created in the underground environment causes formation cracks that help move the bitumen to producing wells. After a portion of the reservoir has been saturated, the steam is turned off and the reservoir is allowed to soak for several weeks. Then the production phase brings the bitumen to the surface.

Density

The heaviness of crude oil, indicating the proportion of large, carbon-rich molecules, generally measured in kilograms per cubic metre (kg/m^3) or degrees on the American Petroleum Institute (API) gravity scale; in western Canada, oil up to $900 \text{ kg}/\text{m}^3$ is considered light to medium crude—oil above this density is deemed as heavy oil or bitumen.

Diluent

see Condensate

Established recoverable reserves

Reserves recoverable under current technology and present and anticipated economic conditions, plus that portion of recoverable reserves that is interpreted to exist, based on geological, geophysical, or similar information, with reasonable certainty.

Established reserves

Reserves recoverable with current technology and present and anticipated economic conditions specifically proved by drilling, testing, or production, plus the portion of contiguous recoverable reserves that are interpreted to exist from geological, geophysical, or similar information with reasonable certainty.

Extraction

A process, unique to the oil sands industry, which separates the bitumen from the oilsand using hot water, steam, and caustic soda.

Froth treatment

The means to recover bitumen from the mixture of water, bitumen, and solids “froth” produced in hot water extraction (in mining-based recovery).

Gasification

A process to partially oxidize any hydrocarbon, typically heavy residues, to a mixture of hydrogen and carbon monoxide. Can be used to produce hydrogen and various energy byproducts.

Greenhouse gases

Gases commonly believed to be connected to climate change and global warming. CO_2 is the most common, but greenhouse gases also include other light hydrocarbons (such as methane) and nitrous oxide.

Initial established reserves

Established reserves prior to the deduction of any production.

Initial volume in place

The volume calculated or interpreted to exist in a reservoir before any volume has been produced.

In situ

Latin for “in place.” In situ recovery refers to various methods used to recover deeply buried bitumen deposits.

In situ combustion

A displacement enhanced oil recovery method. It works by generating combustion gases (primarily CO and CO_2) downhole, which then “pushes” the oil towards the recovery well.

Lease

A legal document from the province of Alberta giving an operator the right to extract bitumen from the oilsand existing within the specified lease area. The land must be reclaimed and returned to the Crown at the end of operations.

Muskeg

A water-soaked layer of decaying plant material, one to three metres thick, found on top of the overburden.

Oil Sands

Bitumen-soaked sand, located in four geographic regions of Alberta: Athabasca, Wabasca, Cold Lake, and Peace River. The Athabasca deposit is the largest, encompassing more than 42,340 square kilometres. Total deposits of bitumen in Alberta are estimated at 1.7 to 2.5 trillion barrels.

Overburden

A layer of sand, gravel, and shale between the surface and the underlying oil sand. Must be removed before oil sands can be mined. Overburden underlies muskeg in many places.

Pilot plant

Small model plant for testing processes under actual production conditions.

Proven recoverable reserves

Reserves that have been proven through production or testing to be recoverable with existing technology and under present economic conditions.

Reclamation

Returning disturbed land to a stable, biologically productive state. Reclaimed property is returned to the province of Alberta at the end of operations.

Remaining established reserves

Initial reserves less cumulative production.

Royalty

The Crown's share of production or revenue. About three quarters of Canadian crude oil is produced from lands, including the oil sands, on which the Crown holds mineral rights. The lease or permit between the developer and the Crown sets out the arrangements for sharing the risks and rewards.

Steam assisted gravity drainage (SAGD)

An in situ production process using two closely spaced horizontal wells: one for steam injection and the other for production of the bitumen/water emulsion.

Synthetic crude oil

A manufactured crude oil comprised of naphtha, distillate, and gas oil-boiling range material. Can range from high quality, light sweet bottom-of-the-crude to heavy, sour blends.

Tailings

A combination of water, sand, silt, and fine clay particles that is a byproduct of removing the bitumen from the oil sand.

Tailings settling basin

The primary purpose of the tailings settling basins is to serve as a process vessel allowing time for tailings water to clarify and silt and clay particles to settle, so the water can be reused in extraction. The settling basin also acts as a thickeners, preparing mature fine tails for final reclamation.

Thermal recovery

Any process by which heat energy is used to reduce the viscosity of bitumen in situ to facilitate recovery.

Toe-to-heel air injection (THAI)

An in situ combustion method for producing heavy oil and oil sand. In this technique, combustion starts from a vertical well, while the oil is produced from a horizontal well having its toe in close proximity to the vertical air-injection well. This production method is a modification of conventional fire flooding techniques in which the flame front from a vertical well pushes the oil to be produced from another vertical well.

Truck-and-shovel mining

Large electric or hydraulic shovels are used to remove the oil sand and load very large trucks. The trucks haul the oil sand to dump trucks where it is conveyed or pipelined to the extraction plant. Trucks and shovels are more economic to operate than the bucket-wheel excavators and draglines they have replaced at oil sand mines.

Upgrading

The process of converting heavy oil or bitumen into synthetic crude either through thermal upgrading (coking) or the addition of hydrogen (hydroconversion).

Vapour extraction (VAPEX)

VAPEX is a non-combustion recovery method that involves injecting a gaseous hydrocarbon solvent into the reservoir where it dissolves up to the oil-like oil, which becomes less viscous (more fluid) before drawing into a lower horizontal well and being extracted.

Viscosity

The ability of a liquid to flow. The lower the viscosity, the faster the liquid will flow.

Glossary of oil sands terms

API

An American Petroleum Institute measure of liquid gravity. Water is 10 degrees API, and a typical light crude is from 35 to 40. Bitumen is 7.5 to 8.5.

Barrel

The traditional measurement for crude oil volumes. One barrel equals 42 US gallons (159 litres). There are 6.29 barrels in one cubic metre of oil.

Bitumen

Naturally occurring, viscous mixture of hydrocarbons that contains high levels of sulphur and nitrogen compounds. In its natural state, it is not recoverable at a commercial rate through a well because it is too thick to flow. Bitumen typically makes up about 10 per cent by weight of oilsand, but saturation varies.

Condensate

Mixture of extremely light hydrocarbons recoverable from gas reservoirs. Condensate is also referred to as a natural gas liquid, and is used as a diluent to reduce bitumen viscosity for pipeline transportation.

Cyclic steam stimulation

For several weeks, high-pressure steam is injected into the formation to soften the oilsand before being pumped to the surface for separation. The pressure created in the underground environment causes formation cracks that help move the bitumen to producing wells. After a portion of the reservoir has been saturated, the steam is turned off and the reservoir is allowed to soak for several weeks. Then the production phase brings the bitumen to the surface.

Density

The heaviness of crude oil, indicating the proportion of large, carbon-rich molecules, generally measured in kilograms per cubic metre (kg/m^3) or degrees on the American Petroleum Institute (API) gravity scale; in western Canada, oil up to $900 \text{ kg}/\text{m}^3$ is considered light to medium crude—oil above this density is deemed as heavy oil or bitumen.

Diluent

see Condensate

Established recoverable reserves

Reserves recoverable under current technology and present and anticipated economic conditions, plus that portion of recoverable reserves that is interpreted to exist, based on geological, geophysical, or similar information, with reasonable certainty.

Established reserves

Reserves recoverable with current technology and present and anticipated economic conditions specifically proved by drilling, testing, or production, plus the portion of contiguous recoverable reserves that are interpreted to exist from geological, geophysical, or similar information with reasonable certainty.

Extraction

A process, unique to the oil sands industry, which separates the bitumen from the oilsand using hot water, steam, and caustic soda.

Froth treatment

The means to recover bitumen from the mixture of water, bitumen, and solids "froth" produced in hot water extraction (in mining-based recovery).

Gasification

A process to partially oxidize any hydrocarbon, typically heavy residues, to a mixture of hydrogen and carbon monoxide. Can be used to produce hydrogen and various energy byproducts.

Greenhouse gases

Gases commonly believed to be connected to climate change and global warming. CO_2 is the most common, but greenhouse gases also include other light hydrocarbons (such as methane) and nitrous oxide.

Initial established reserves

Established reserves prior to the deduction of any production.

Initial volume in place

The volume calculated or interpreted to exist in a reservoir before any volume has been produced.

In situ

Latin for "in place." In situ recovery refers to various methods used to recover deeply buried bitumen deposits.

In situ combustion

A displacement enhanced oil recovery method. It works by generating combustion gases ($\text{primarily CO and CO}_2$) downhole, which then "pushes" the oil towards the recovery well.

Lease

A legal document from the province of Alberta giving an operator the right to extract bitumen from the oilsand existing within the specified lease area. The land must be reclaimed and returned to the Crown at the end of operations.

Muskeg

A water-soaked layer of decaying plant material, one to three metres thick, found on top of the overburden.

Oil Sands

Bitumen-soaked sand, located in four geographic regions of Alberta: Athabasca, Wabasca, Cold Lake, and Peace River. The Athabasca Deposit is the largest, encompassing more than 42,340 square kilometres. Total deposits of bitumen in Alberta are estimated at 1.7 to 2.5 trillion barrels.

Overburden

A layer of sand, gravel, and shale between the surface and the underlying oil sand. Must be removed before oil sands can be mined. Overburden underlies muskeg in many places.

Pilot plant

Small model plant for testing processes under actual production conditions.

Proven recoverable reserves

Reserves that have been proven through production or testing to be recoverable with existing technology and under present economic conditions.

Reclamation

Returning disturbed land to a stable, biologically productive state. Reclaimed property is returned to the province of Alberta at the end of operations.

Remaining established reserves

Initial reserves less cumulative production.

Royalty

The Crown's share of production or revenue. About three quarters of Canadian crude oil is produced from lands, including the oil sands, on which the Crown holds mineral rights. The lease or permit between the developer and the Crown sets out the arrangements for sharing the risks and rewards.

Steam assisted gravity drainage (SAGD)

An in situ production process using two closely spaced horizontal wells: one for steam injection and the other for production of the bitumen/water emulsion.

Synthetic crude oil

A manufactured crude oil comprised of naphtha, distillate, and gas oil-boiling range material. Can range from high-quality, light sweet bottom-of-the crude to heavy, sour blends.

Tailings

A combination of water, sand, silt, and fine clay particles that is a byproduct of removing the bitumen from the oil sand.

Tailings settling basin

The primary purpose of the tailings settling basin is to serve as a process vessel allowing time for tailings water to clarify and silt and clay particles to settle, so the water can be reused in extraction. The settling basin also acts as a thickener, preparing mature fine tails for final reclamation.

Thermal recovery

Any process by which heat energy is used to reduce the viscosity of bitumen in situ to facilitate recovery.

Toe-to-heel air injection (THAI)

An in situ combustion method for producing heavy oil and sand. In this technique, combustion starts from a vertical well, while the oil is produced from a horizontal well having its toe in close proximity to the vertical air-injection well. This production method is a modification of conventional fire flooding techniques in which the flame front from a vertical well pushes the oil to be produced from another vertical well.

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CONTACTS

The latest on oil sands projects in Alberta

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